

ANSWERS: Major and minor products

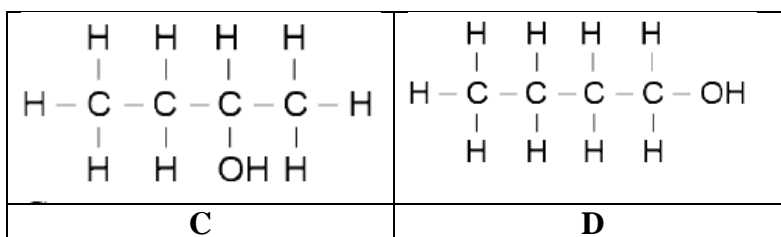
1. Reaction 1 forms only one product because the carbon atom from which the H is removed (C1 or C3) does not affect the structure of the product as propan-2-ol is symmetrical.

Reaction 2 produces two products because an asymmetric reagent (H-OH) adds onto an asymmetric alkene ($\text{CH}_3\text{CH}=\text{CH}_2$). There are two carbons that the H or OH can bond with (C1 and C2), so there are two possible combinations. We can predict which will be the major product by using Markovnikov's rule, which states that the carbon with the most hydrogens gains more hydrogens. This means that most of the time, C1 will get another hydrogen while C2 will get the OH in this reaction. Propan-2-ol will be the major product and propan-1-ol the minor product.

2. It is the major product because the hydrogen atom from HCl more often adds onto the carbon atom in the double bond which already contains the most hydrogen atoms; in this case, C1. Therefore the Cl atom from the HCl joins onto the carbon atom in the double bond which had the least number of hydrogen atoms; in this case, C2.

3. Major product – the carbon with the least hydrogen atoms attached loses another hydrogen atom (to form the double bond).

4.

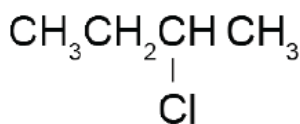
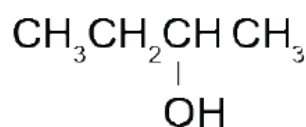


C is the major product and **D** is the minor product.

There are 2 possible products because when the double bond is broken, an H (or –OH) will bond to one C (and a –OH group (or H)

will bond with the other C). The product will depend on which (C) the H (or the –OH) bond to.

C must be

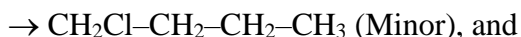


since product **E** is

i.e. both functional groups are on the

second carbon atom. If $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$ was **C** then **E** would be $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl}$.

5. Reaction of HCl with but-1-ene



Reaction of HCl with but-2-ene



Both reactions are addition reactions. An addition reaction involves breaking the double bond between the carbon atoms, forming a carbon to carbon single bond. One H atom adds to one of the C atoms and Cl adds to the other C atom.

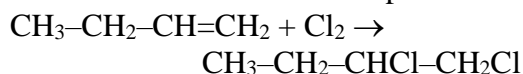
But-1-ene reacts to form two products, as the molecule is unsymmetrical. A major and minor product forms, as the chlorine atom can add to either the first or second carbon making two different products. The major product occurs when the hydrogen atom adds to the carbon atom (the 1st carbon) in the double bond that already has the most hydrogen atoms attached to it. Therefore the chlorine atom adds to the second carbon. The minor product has the hydrogen on the second carbon atom and the chlorine on the first carbon atom.

But-2-ene only has one product, as the molecule is symmetrical. This means it does not matter which carbon atom the hydrogen and chlorine atom add to as the chlorine will always be in the third position.

6. Both reactions are addition reactions. **This involves breaking the double bond between the carbon atoms** in but-1-ene and forming a single bond in its place, as well as forming two new single bonds. With Cl_2 , the new single bonds formed are both C–Cl bonds. With HCl , the new single bonds are a C–Cl bond and a C–H bond.

With Cl_2

But-1-ene reacts to form one product



With HCl

But-1-ene reacts to form two products.

This is because but-1-ene is an asymmetric alkene (one carbon atom of the double bond has different groups attached to it).

$\text{CH}_3\text{--CH}_2\text{--CHClCH}_3$ is the major product because the H from HCl will bond to the carbon atom with the greatest number of H atoms.

